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Research Note

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EFFECT OF THINNING ON THE SPECIFIC GRAVITY OF WESTERN LARCH CROP TREES

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ABSTRACT

Thinning programs have been started that will eventually encompass a million acres of the larch-type timber stands. The objective is to speed up growth in a selected number of trees. This study was made to determine how reduction in stand competition affects specific gravities of such trees. Increment cores taken from trees in study plots that were thinned 15 years earlier indicate that specific gravities did increase and that these increases could be related to the reduction in stand competition.

Although western larch (*Larix occidentalis* Nutt.) has limited range in the United States, it is one of the more valuable timber species in the northern Rockies. The relatively high specific gravity and corresponding strength characteristics make larch lumber and plywood especially well suited for structural purposes.

Many natural stands of young larch, growing on burned and harvested areas, are badly overstocked. Thinning programs that will eventually encompass a million acres in the larch type have been started. Objectives of these programs are to concentrate the growth on fewer trees and to produce larger trees at an earlier age. The usual response of a tree to reduced competition or thinning is increased growth. However, this response may be delayed for a few years until the tree's crown and root system have expanded and can utilize the added growing space.

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Specific gravity often increases after thinning because of the increase in available soil moisture which favors extended summerwood growth. When stand competition has been renewed, specific gravity may decrease as a result of the intensified use of the available soil moisture.

It is generally recognized that stand competition has a major influence on the growth rate of individual trees. Paul (2)[2] and others conclude, as a result of research on other tree species, that specific gravity is closely correlated with growth rate--if the increased growth results in an increase in the summerwood. In general, specific gravity of summerwood averages two or three times that of springwood. Smith (4), working with Douglas-fir, established a very close relation between percent summerwood and specific gravity. Apparently, specific gravity fluctuates in response to the environmental factors that favor development of either springwood or summerwood.

Spurr and Hsiung (5) cite several studies that indicate that specific gravity generally increases from pith to circumference. Other studies indicate that specific gravity is sometimes correlated with age, ring width, exposure, and nature of terrain, but is not necessarily correlated with site class, stand density, stem diameter, or crown class. Roe and Schmidt (3) showed that diameter, basal area, and cubic-foot volume growth on individual trees increase when larch stands are thinned. No information is available on how reduced stand competition affects the specific gravity of western larch crop trees. The question remains: What effect will thinning have on the specific gravity of larch? This study was made to answer this question.

STUDY AREA AND PROCEDURE

Five 1/2-acre-square plots were established in 1949 on the Lolo National Forest in Montana at an elevation of 4,200 feet. Slopes range from 25 to 55 percent and exposures are principally north to northeast.

The study plots were established in a stand consisting principally of western larch trees, and lesser numbers of lodgepole pine and Douglas-fir. Ponderosa pine, Engelmann spruce, grand fir, and subalpine fir were also found. The stand was about 50 years old and originated following a burn. The average site index for the stand was determined as 52 feet at 50 years (site class III) according to Cummings' classification curves (1).

Four of the five plots were randomly selected for thinning treatments. The fifth plot was left unthinned to serve as a control. Crop trees were chosen and identified on all plots at the rate of about 150 trees per acre, spaced roughly 15 feet apart. Preference was given to western larch, ponderosa pine, Douglas-fir, and lodgepole pine in that order. Only dominant and codominant trees of good form and of fair to good vigor were selected as crop trees.

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[2] Underlined numerals in parentheses refer to numbered items in Literature Cited, at end of this paper.

On plots 1 and 2, the "D+4" rule of thumb was applied to individual crop trees. All trees were cut from around each crop tree for a radial distance in feet equal to the diameter of the tree in inches plus 4.

On plots 3 and 4, trees were cut for a radius of 3 to 6 feet from the crown edge on at least three sides of each crop tree.

Trees were removed in October 1949 by cutting the smaller stems and girdling and poisoning the larger stems. All larch and ponderosa pine crop trees were pruned to a height of about 18 feet. Pruning of live branches sometimes decreases growth and specific gravity, but the effect was probably negligible in this study because very few live branches were removed.

Table 1.--Mean diameter, number of trees, and basal area on study plots before thinning

Treatment and plot number	Mean d.b.h.	Trees per acre	Basal area per acre
	Inches		Square feet
1	3.4	1,586	103.0
2	3.8	1,396	111.0
3	3.9	1,410	118.0
4	3.2	1,886	106.0
5	3.9	1,668	135.0

Measurements at 5-year intervals included diameter and heights of individual crop trees and plot basal areas. Increment cores from all larch crop trees 15 years after thinning were extracted with a calibrated increment borer and were used for determining specific gravity. All field measurements were made in the fall after the year's growth had been completed.

In the laboratory, the cores were immersed under water for at least 24 hours to bring them to a green condition. Then, each core was cut at a point 15 growth rings in from the cambium. The specific gravity of the two segments, before and after treatment, based on green volume and ovendry weight was then determined by the method described by Wahlgren and Fassnacht (6). These data were subjected to covariance analysis.

RESULTS AND DISCUSSION

The average specific gravity of crop trees on all plots, thinned and unthinned, increased during the 15-year study period (table 2). However, the greatest changes were in the thinned plots. Increases in the thinned plots ranged from 0.032 (plot 4) to 0.049 (plot 1).

Table 2.--Basal areas for all trees, and basal areas, mean diameters, and changes in average specific gravity of the larch crop trees

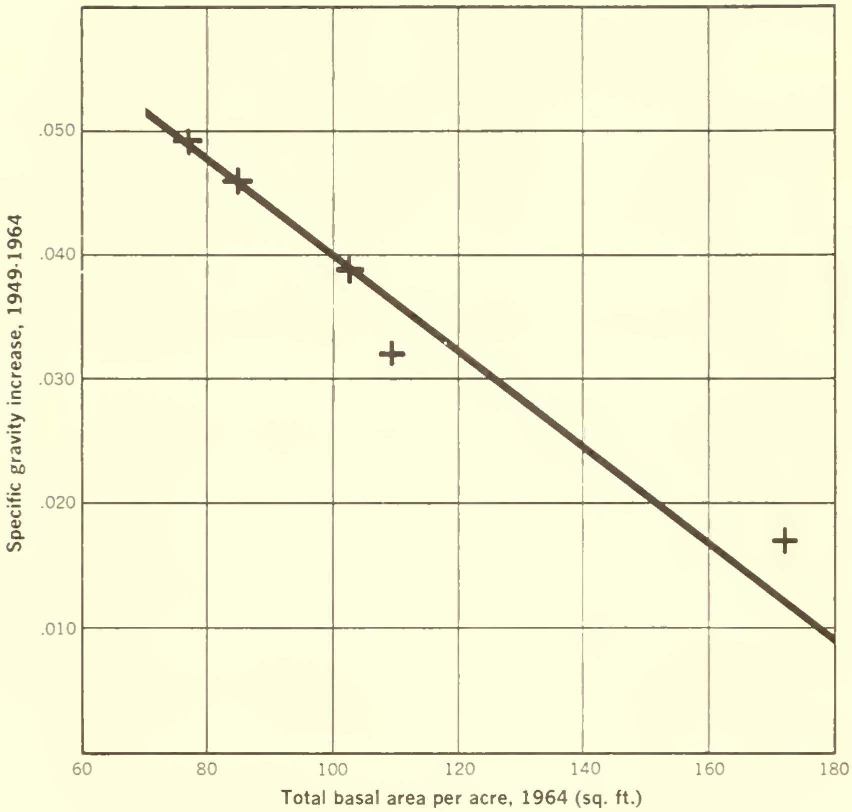
Treatment and plot number	Basal area all trees		Larch crop trees							
			Number	Basal area		Mean d.b.h.		Average specific gravity		
	1949	1964		1949	1964	1949	1964	Before 1949	After 1949	Increase
	Square feet per acre		Per acre	Square feet per acre		Inches	Inches			
D+4 (1)	44.2	75.6	138	26.6	42.8	6.0	7.6	0.514	0.563	0.049
D+4 (2)	58.8	83.8	141	23.6	36.6	5.5	6.9	.510	.556	.046
Crown (3)	81.6	102.0	114	21.0	32.0	5.8	7.2	.497	.536	.039
Crown (4)	73.4	109.2	154	30.8	49.8	6.1	7.7	.503	.535	.032
Unthinned (5)	135.0	172.0	124	29.2	39.6	6.6	7.7	.501	.518	.017

Meanwhile the increase in the unthinned plot was only 0.017. The average increase in specific gravity for the unthinned plot can probably be attributed to the change in specific gravity that occurs with larger diameter. Percent summerwood was not determined, but examination of cores showed more summerwood present in cores from trees on the thinned plots than in cores from trees on the unthinned plots.

In order to evaluate the difference in specific gravity change (1949-1964) between the thinning and control treatments, variances between and within the replicated plots were assumed to be applicable to the control, represented by a single plot. Initial tree diameter (1949) was used as a covariate to adjust for starting tree-size differences between plots of the treatments. In this analysis, the difference between thinned and unthinned plots was established at the 0.001 level. The results of this analysis therefore verified the apparent differences between plots exhibited by the raw data.

The increase in specific gravity during the 1949-1964 period was strongly related to the total basal area in 1964 (fig. 1). This linear relation demonstrates that specific gravity increased most on plots having the least basal area stocking. After 15 years, total basal area growth on the unthinned plot still exceeds that on the thinned plots because it more fully occupies the site. However, without further thinning, total basal areas on all plots will eventually reach about the same level, and differences in specific gravity will probably disappear. In the meantime, diameter and basal area growth on the thinned areas is being channeled to fewer and better trees. Such trees, as a result, will grow to larger sizes sooner. Besides being larger than their unthinned counterparts, these trees will have a bonus of superior density and strength properties.

Figure 1.--Effect of total basal area on average 15-year change in specific gravity of western larch crop trees.



CONCLUSIONS

The results of this study show that wood quality, as indicated by specific gravity, is improved by reducing stand competition. Specific gravity increases more on larch crop trees in thinned stands than comparable trees in unthinned stands. The rate of increase in specific gravity is related to the intensity of competition as determined by basal area--the greater the competitive intensity, the less the increase in specific gravity.

The trends shown in this study should interest forest managers who manage stands destined for structural lumber or for yield of actual wood. Not only does reduction of competition increase the diameter and basal area growth of larch crop trees, it also increases the specific gravity and consequently improves the properties of this important species.

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